





Drilling into ancient aquifer in Namibia Source: Metronewspaper.co.za





Rivers support a wide variety of life and sometimes it is taken for granted that they have enough water in them. Often the building of dams cut off the rivers flow and catch all the water that would normally have formed part of a flood event downstream. When a river has enough water in it to flow properly and support life it is said to have a good 'ecological reserve' This is important as good flows scour (dig out) the river bed and they help dilute any pollutant or waste water (effluents).

### Water for a living river

# Orange-Senqu Basin Catchment Cards

Groundwater is primarily abstracted through boreholes (groundwater wells), drilled from the surface by a drilling rig. Boreholes are the most common form for abstracting groundwater in southern Africa. This drinking trough is supplied by solar power, which enables the pumping of water in remote areas where there is no electricity supply. There are two types of aquifers (ground water supplies) in the region. Shallow alluvial primary aquifers along the river, and a variety of deeper hard rock secondary aquifers.

Drilling into ancient aquifer in Namibia

# Orange-Senqu Basin Catchment Cards

The watershed is the point at which water flows downhill into a particular valley by gravity. It is the highest point that separates the path that runoff will take, some flowing into the valley on one side of the watershed and some into the valley on the other side.

#### Watershed

Orange-Senqu Basin Catchment Cards

The world cannot make more water, it is a finite resource. Half the world's population live in water scarce areas like the Orange-Senqu Basin. It is important to conserve water and take care of the catchment basin in a sustainable way so that there is enough for everyone in the future. One in every nine people in the world do not have access to clean running water.

### Water is Important!

# Orange-Senqu Basin Catchment Cards

20 Million people live in the Orange-Senqu River basin. Most of this population resides in South Africa (85%) and Lesotho (13%). There are not many people living in the northern and western parts of the basin. To be able to use the water in a fair and sustainable way, each country needs to work out what share each country will need. Planning frameworks and agreements ensure that this happens fairly. The same principles should apply at a local level. No-one should be allowed to take too much water, while others have none.

### Water to meet people's needs

### Orange-Senqu Basin Catchment Cards

Groundwater is used extensively throughout the southern African region, including the Orange-Senqu River basin, supplying a significant percentage of water for irrigation, industrial, mining, domestic and rural water supply schemes. This is especially true in rural areas, located away from surface water resources. This borehole is operated by a solar powered pump which pumps water to the livestock drinking trough.

#### Solar powered borehole drinking trough





Perennial river - Senqu at source Source: Lesotho Water Commission 2003



Source: OrasekomRAK



Water for Industry & Mining (Sasol) Source: OrasecomRAK





Like the Senqu, some rivers are born from springs and fed at first from runoff rainfall which later collects in the valley bottom in wetlands that act as a **sponge**, slowing and storing water and releasing it slowly to feed the river all year round. These rivers are called **perennial** rivers.

#### Perennial river - Senqu at source

# Orange-Senqu Basin Catchment Cards

The Orange River basin is the largest basin south of the Zambezi covering almost one million square kilometres. It is also the most developed transboundary river basin in the southern African region. There are a number of water transfer schemes to supply water to municipalities, industries and farms in and outside of the basin One of the most industrially developed parts of Africa (the region around Johannesburg, South Africa) is situated in the basin and the Orange-Senqu River system supports a range of commercial, industrial and mining water needs.

Water for human settlement, industry and mining

## Orange-Senqu Basin Catchment Cards

The Namaqualand Uplands includes the highlands of central Namaqualand in the Northern Cape Province. The area is known for its spectacular displays of spring flowers and high diversity of bulbous flowers. This area is 360 810 ha and includes 1109 species of plants. Of these 286 are found nowhere else and 107 are threatened. The area contains large areas of vegetation between succulent and fynbos habitats. These are important areas for plant adaptation and resilience to climate change. Rainfall in Namaqualand averages 100 mm per year. During summer, temperatures can hit the 40 degrees.

## The Southern Namib Desert

### Orange-Senqu Basin Catchment Cards

Some rivers only flow in the rainy season for a short time. These rivers are called **seasonal**, or **ephemeral**. Most of the rivers in Botswana and Namibia only flow from time to time after heavy rainstorms. In some areas there are pools of surface groundwater, but many are just dry river beds with no or very little vegetation. Plants and animals are specially adapted to live in these arid conditions.

#### Seasonal (ephemeral) river

### Orange-Senqu Basin Catchment Cards

The amount of water that is available for use in the Orange-Senqu Basin is 'approaching closure'. This means that the amount of run off and the amount of water used is nearly equal. Meeting the growing needs for development will soon be very difficult unless effective water demand measures are implemented. This includes determining how much each country can use, the conservation of water resources and making sure that infrastructure, like water pipes, are in good repair and monitoring usage.

#### Water leaks cause urban wastage

# Orange-Senqu Basin Catchment Cards

The Great Escarpment extends from the western edge of the Namibia and Angola plateaux, right around South Africa and north to the Zambezi River in Zimbabwe. This feature varies in height, reaching its maximum in the Drakensberg Mountains of South Africa at approximately 3 299 m above sea level. The Orange-Senqu River basin lies almost entirely within the Great Escarpment.

**The Great Escarpment Mountains** 





Vaal Basin: water supports 12 million people





The Mouth of the Orange-Senqu Source: Agar 1998



Lower Orange-Senqu Wetland Streambank Setting



The Vaal catchment has a large population of urbanised (city) people. About 48 percent of the population of South Africa live in the Vaal catchment and rely on its water. The majority of South Africa's heavy industry and mining activities are also situated within the catchment. Much of the catchment areas are heavily modified by impoundments and water transfer schemes both removing and adding to the natural water supply to make up for the natural variability of the water flow.

### Vaal Basin: water supports 12 million people

# Orange-Senqu Basin Catchment Cards

The mouth of the Orange-Senqu river is called an estuary. Mostly the mouth is open to the sea and the fresh water and sea water mix. More recently low flows have washed sand bars up to close the mouth and this affects the water quality and functioning of the estuary. The estuary has salt marshes and sand bars that extend about 9km inland. It is a place where birds like to feed and breed and many stop over on long migration flights. The estuary is recognised internationally as a Ramsar Site. Many people are worried that it is no longer as healthy as it was and are working to restore it.

### The mouth of the Orange-Senqu

# Orange-Senqu Basin Catchment Cards

*"miniSASS stands for mini stream assessment scoring system.* It involves looking for aquatic invertebrates (water creatures) in as many of the different habitats you can find at a river site. You can also pick up stones and brush the insects off with a toothbrush or paintbrush or pick them off with your fingers and put them into your net. Rinse any mud out of the net then turn the contents into a plastic tray or ice cream container. Identify each group using the miniSASS sheet and make a note of how many of each species you find. In this way you can tell if the river is healthy or not.

miniSASS looking under rocks

# Orange-Senqu Basin Catchment Cards

Over 80 percent of the Lesotho population live in the lowlands where soil conditions are more favourable for agriculture. In rural Lesotho a nucleus of family groups build their huts in a spaced fashion around their livestock kraal. Traditional huts are round and are constructed of mud and dung walls with thatched roofs. These are often decorated with bright designs. Each village has a meeting place where business is conducted. The areas around the villages are owned in common by the people and the land is assigned by the chief for family farming.

### **Rural homestead in Lesotho highlands**

# Orange-Senqu Basin Catchment Cards

It is very important to monitor the amounts of water that are used in the system so that this remains sustainable. Groundwater, surface water (both flow and quality) flow, ecosystems health and resource management should all be monitored. Citizen science introduces tools that people can use to help monitor the basin. Techniques such as MiniSASS (Mini Stream Scoring Assessment) can be used very effectively to build a picture of basin health, while at the same time deepening the understanding of local people and involving them in finding solutions to the challenges that the basin is facing.

# Citizen Science – Monitoring & Complience

# Orange-Senqu Basin Catchment Cards

A wetland is a place between dry land and a water body where the soil is waterlogged for all, or part, of the year. The water may be flowing or standing, and fresh, brackish or salt. These wetlands can be found in steeper valleys just below the watershed. These settings are easily overlooked as "wetlands" because they are often the only green patches in an otherwise dry landscape. Unfortunately these areas are overused, especially by animals, and many are just the dongas on our hillsides. – The Lesotho Highlands and Drakensberg Park has many examples of stream source settings.

Lower Orange-Senqu Wetland Streambank Setting







Subsistence Karakul goat farming (Namibia) Source:DRFN 2004 Orange-Senqu RAK





Source: by Octgon via Wikimedia Commons

Source: McNutt 2008 Orange-Senqu RAK



Otters are indicator species of healthy wetland and river systems. That means that if otters are present you can tell that there will be all the creatures needed to keep the ecology (the relationship between the creatures and their homes) healthy. Crabs are reducers that feed on dead organic matter. They also catch some live prey. Together with the decomposers like worms, bacteria and fungi, the reducers help clean up the ecosystem of decaying matter.

### Tertiary Consumer (Otter) eating Reducer (crab)

# Orange-Senqu Basin Catchment Cards

Sixty four percent of Namibians are subsistence farmers susceptible to food shortages during times of drought. Most subsistence farming occurs in the northern areas of the country and is concentrated on food crops with livestock produced for local consumption.

Commercial agriculture is dominated by livestock ranching in the southern and central regions. In the south of Namibia, farming is mostly small stock.

### Subsistence Karakul goat farming (Namibia)

# Orange-Senqu Basin Catchment Cards

In Lesotho most people practice subsistence farming. People grow food for their own consumption and where possible, maintain small to medium sized herds of cattle and goats. The main crops that are grown include maize, wheat, and sorghum, as well as peas, beans, and potatoes. There are good farming areas in the northwest lowlands, surrounding the capital of Maseru. The rest of the country is either too mountainous or generally too dry to produce sufficient crops.

**Subsistence Agriculture** 

## Orange-Senqu Basin Catchment Cards

Some aquatic invertebrates (water creatures) like mayflies and stoneflies live under stones in unpolluted running water. The nymphs of stoneflies have two thin 'tails'. Nymphs eat small water insects and algae. If one finds stoneflies in a stream, it usually indicates good water quality as they are affected by small amounts of pollution. Streams high up in the source of the river are more likely to be in natural condition because there is less likelihood of pollution.

#### miniSASS ID in Upper Orange-Senqu

# Orange-Senqu Basin Catchment Cards

The Katze Botanical Garden has a unique collection representing the dry Senqu River vegetation. It has a large plant propagation area. The gardens provide opportunities for community based resource management and outreach programmes that work towards conservation and sustainable use of botanical resources and strengthen eco-tourism and education. miniMOMs is a system of management orientated monitoring where local people can learn techniques to monitor the land that they are looking after and help reduce impacts.

#### Katze Botanical Gardens

# Orange-Senqu Basin Catchment Cards

Artisanal fishing is another name for traditional fishing and these include various small-scale fishing practices run by individual fishing households rather than commercial companies. Their fish is usually not processed and is mainly for local consumption. Artisan fishing uses traditional fishing techniques such as rod and tackle, fish arrows, harpoons and cast nets as well as small traditional fishing boats.

**Subsistence Fishing** 



Source: Earthorg





Katse Dam, Malibamutso River, Lesotho Source : OrangeSenquRAK



Gariep Dam, Upper Orange, South Africa Source : Wikipedia Commons





Solid waste from illegal dumps ends up in the river

Recently, there have been many concerns about water from abandoned and closed mines polluting water supplies for human and agricultural uses. This is called acid mine drainage. This acidic water has poisoned much of the wetlands and streams in the Gauteng area of the upper Vaal Sub-basin and is threatening the Orange-Senqu system.

### Acid mine drainage into Tweelopie Spruit

# Orange-Senqu Basin Catchment Cards

The Gariep Dam forms the largest storage reservoir in South Africa with a total storage of approximately 5 500 Mm<sup>3</sup> and a surface area of more than 370 km<sup>2</sup> when full. The dam is the central structure of the original Orange River Project which involves the supply of water to parts of the Vaal, Fish and Sundays catchments as well as to irrigation along the Orange River itself. The Gariep Dam is 88m high with a crest length of 914m. It has four large generators that run the hydro-electric plant. It is situated at the entrance to the Ruite Valley, 5km east of Norvalspont.

### Gariep Dam, Upper Orange, South Africa

## Orange-Senqu Basin Catchment Cards

Many people use rivers to illegally dump waste, especially near cities. This leads to a number of problems in rivers, dams and the sea. Solid waste like plastic gets eaten by animals or caught around the feet of birds, causing them to die of starvation. Many plastics also give off endocrine mimicking substances that have a negative effect on human and animal development. Plastic waste ends up in the sea and there is a plastic 'gyre', a huge area of waste plastic out to sea that is very harmful to all sea life. All plastic should be recycled. Untreated sewage (human waste) can also cause serious pollution in rivers and dams.

Solid waste from illegal dumps ends up in the river

# Orange-Senqu Basin Catchment Cards

Namibia is one of the world's largest diamond producers and uranium exporters. Although uranium is not produced within the Orange-Senqu River basin, a majority of diamond mines are located in the basin. The mining sector only employs 3% of the population, but it accounts for over 9% of the GDP, and generates more than 50% of foreign exchange earnings in Namibia. Here a diamond mine is being rehabilitated after this section was mined out.

#### **Diamond Mine Rehabilitation**

# Orange-Senqu Basin Catchment Cards

The Katse Dam forms the main dam of the Lesotho Highlands Water Project known as Phase 1. The dam was completed in 1997 and is situated in the Malibamatso Valley just below the Bokong River. The Dam is the water storage and collection area from which all transfers from Lesotho to South Africa flow through approximately 80 km of concrete lined tunnels. The reservoir formed by the Katse Dam is very narrow, winding and deep with a surface area at full supply level of only 35,8 km<sup>2</sup>.

#### Katse Dam, Malibamutso River, Lesotho

# Orange-Senqu Basin Catchment Cards

Maintaining water quality is very important for communities throughout the Orange-Senqu River basin, and is required to achieve Millennium Development Goals (MDGs) Of the eight goals the protection of water quality in the river system directly or indirectly contributes to the fulfilment of the following four: These are to eradicate extreme poverty and hunger, to reduce child mortality, to combat disease, and to ensure environmental sustainability.

Human settlements poor water quality